

MAGNITUDE OF HEAT STRESS ON LIVESTOCK: A COMPARATIVE STUDY OF TEMPERATURE HUMIDITY INDEX ACROSS DIFFERENT CLIMATIC ZONES

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Heat stress is a condition that negatively affects the performance of livestock. This study examined the magnitude of heat stress in livestock by analyzing the Temperature Humidity Index (THI) across three climatic zones in Sri Lanka over the past five years. The daily THI was calculated for cattle (THI_{cattle}), broilers (THI_{broiler}), layers (THI_{layer}), and swine (THI_{swine}) using category-specific thermal models for 12 locations to represent wet zone (WZ), intermediate zone (IZ) and dry zone (DZ). Those values were used to analyze the monthly and annual variations within and across the zones and to calculate the number of days higher than the threshold (THI_{threshold}) for each livestock category. The data were analyzed by one-way analysis of variance. The results indicated that the THI_{cattle} fluctuated in a wider range from 53.28 to 97.08 while the THI_{broiler} ranged from 19.90 to 36.48. Further, the THI_{layer} ranged from 19.00 to 33.82, and THI_{swine} varied from 19.10 to 36.96. Further, THI_{broiler}, THI_{layer}, and THI_{swine} were significantly higher ($p < 0.05$) in the DZ compared to the WZ and IZ while THI_{cattle} were significantly higher ($p < 0.05$) in both WZ and DZ compared to the IZ. Furthermore, the THI index indicated that cattle in the DZ were above the THI_{threshold} for 348 ± 17 days year⁻¹, while in the IZ, it was reported as 260 ± 22 days year⁻¹. The number of days higher than the THI_{threshold} for cattle and layers was significantly higher in the DZ and WZ ($p < 0.05$) than IZ. The THI_{broiler} and THI_{swine} indicated that the THI_{threshold} was above 300 days year⁻¹ and 267 ± 31 days year⁻¹, respectively, regardless of the climatic zone. These findings highlight the need for climatic zonal and species-specific heat stress management strategies, especially in the dry zone during the peak months to enhance livestock productivity and welfare.

Keywords: Category-specific thermal models, Days above threshold, Dry zone, Intermediate zone, Wet zone